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Review

Exploring the relationship between internal pressures, greenhouse gas management and performance of Brazilian companies

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ABSTRACT

This study analyzes the relationship between the internal factors of Corporate Social Responsibility (CSR) of an Environmental Management System (EMS) and the reduction in greenhouse gas (GHG) emissions and economic performance (EP). We examine how internal CSR factors such as accountability, incentives, and training moderate the relationship between EMS and reduction in GHG and EP for 63 large Brazilian companies. For data analysis, we used structural equations and Partial Least Squares software. The results show a significant relationship between EMS implementation and reduction in GHG emissions and EP. The study also shows that risk management and the pursuit of opportunities related to climate change, the establishment of incentives at different levels based on reduction targets; and that employee awareness and training have a significant impact on the management of GHG emissions and the greenhouse effect. Thus, the study clearly shows the influence of internal factors in the management of environmental performance through EMS implementation.

Contents

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1. Introduction

Unsustainable tendencies in the co-evolution of human and natural systems have stimulated a search for new approaches to the study of complex problems associated with the environment and development. Recently, a new "sustainability science" has emerged, and core questions and research strategies have been proposed. A key challenge related to sustainability is climate change (Swart et al., 2004).

Environmental management systems (EMS) plan, develop, implement, coordinate, and monitor business activities to mitigate and prevent environmental impacts (Melnyk et al., 2002). The broad design of management control systems helps organizations to adopt sustainability policies for long-term performance (Naranjo-Gil, 2016). According to Nawaz and Koç (2018), organizations and top management recognize the importance of sustainability, but vague definitions and lack of a robust framework impede the management of sustainability in organizations. The two main purposes of EMS are the reduction of GHG (RGHG) emissions (Rosa et al., 2015) and economic performance (EP) (Capece et al., 2017). A firm's responsibility will be highly rated when its GHG emissions are less because the benefits will go to all members of the society (Yu and Lee, 2017).

The better the company's EP, the more the information that will be disclosed on its environmental investment and pollution control cost (Liu and Anbumozhi, 2009). Environmental disclosure is the process by which businesses divulge their impact on the environment (Rosa et al., 2012). EMS can be affected by external factors such as regulatory pressure (Kuo et al., 2012), consumer pressure (Chuang and Qianfei, 2013), and competitive advantage (Porter and Van der Linde, 1995). It can also be affected by internal factors such as accountability, incentives, and training. These factors relate to the managers' commitment and responsibility for their actions and decisions related to environmental measures, the employees' incentives and motivation linked to environmental performance targets, and the employees' increased awareness of environmental issues.

The literature has paid more attention to the external factors that affect EMS implementation. Little attention has been paid to studying the relationship between the internal factors such as accountability, incentives, and training and EMS implementation. It is necessary to have a better understanding of how the internal factors influence the level of the commitment, motivation, and awareness of managers and other employees on the environmental measures such as RGHG emissions. This is because these factors can determine EMS implementation and the consequent RGHG emissions and EP. For example, environmental training can enable one to understand data and identify the potential solutions in case of deviations (Albelda-Perez et al., 2007). Aguinis and Glavas (2012) highlight the need for broad debates on the internal CSR perspective, pointing out the weaknesses in the literature regarding the influence of factors related to managers and employees. Therefore, a better understanding of CSR is essential, especially for the internal factors that influence the effectiveness of EMS.

Research on the effectiveness of EMS for RGHG emissions remains incomplete and fragmented. Therefore, in this study, we try to extend the previous studies at the interface between CSR and EMS, and explore how managers and employees can support the effective use of the system. Thus, we analyze how EMS, CSR, and the internal factors are related to RGHG and EP. The survey analyses the voluntary and publicly available responses obtained from 63 Brazilian companies that were active in 2016.

This study contributes to the current literature on EMS and provides empirical evidence on how EMS reduces GHG emissions. It furthers the understanding of the internal factors that influence the effectiveness of EMS and recognizes the different factors involved in environmental management. In addition, we elucidate the complex relationships between the internal CSR factors of, EMS implementation to reduce gas emissions, and EP. Specifically, we propose and present quantitative evidence that the internal factors related to managers and employees are an important moderator for the effective use of EMS for RGHG emissions and EP.

This study also extends previous research by developing a more comprehensive and integrated model and demonstrates that EMS, along with the internal CSR factors, can produce better results. The empirical evidence for this relationship in the literature is relatively limited. The remainder of this paper is organized as follows. The next section first analyzes the literature related to EMS, the internal CSR factors, and RGHG emissions, and then formulates and explains the research hypotheses. Section 3 presents the population and sample, the measures, and statistical analysis of the research. Section 4 presents the results of the study. The final section provides the conclusions, limitations, and some extensions of the research.

2. Literature review and hypotheses development

This section briefly describes the concept of EMS and CSR. Based on this information, we develop the hypotheses of this study.

2.1. Environmental management systems

Companies have been urged to manage the environmental impacts of increased pollution, which is threatening the global ecosystem. Foremost among the environmental hazards are the climate changes mainly due to GHG emissions (Chan and Wong, 2006). These have devastating effects on the planet, such as drought, melting of glaciers, flooding in coastal regions, intensification of phenomena such as hurricanes, loss of biodiversity, higher incidence of diseases, and increased migration, besides the other physical and ecological changes observed on Earth.

Thus, firms are now required to actively seek ways to minimize their exposure to risk and take a proactive approach to environmental management (Phan and Baird, 2015). This scenario has forced firms to adopt EMS (Fryxell and Szeto, 2002), which can be used to plan, develop, implement, coordinate, and monitor business activities and set compliance standards aiming to mitigate and prevent environmental impacts (Melnyk et al., 2002). In this context, EMS can be seen as a structured tool (Rowland-Jones et al., 2005) to integrate the environmental aspects into company strategies and the decision-making chain. This system consists of several factors such as organizational structure; assignment of responsibilities; and planning the practices, procedures, processes, and resources needed for the policy and goals (Fortunski, 2008). A good EMS consists of two steps. First, the firm should uncover ways to reduce its environmental impacts, while simultaneously reducing costs or increasing productivity. Second, it should coordinate the environmental activities of firms to achieve greater organizational efficiency and effectiveness (Bansal and Bogner, 2002).

Thus, the EMS consists of decision-making technical and economic criteria (Guerrero-Baena et al., 2015), and is influenced by external factors such as regulatory compliance pressures (Kuo et al., 2012), consumer pressures (Chuang and Qianfei, 2013), competitive advantage (Porter and Van der Linde, 1995), and internal issues related to the workplace, corporate culture, and innovation (Chuang and Qianfei, 2013). From the management point of view, various factors need be considered for environmental practices, such as managers' commitment, adequate resources, efficient communications, and training (Zutshi and Sohal, 2004). Chuang and Qianfei (2013) argue that under this understanding of

environmental management, companies should ask managers to internalize environmental issues into their own culture and values. Thus, employees should take the initiative to enhance corporate environmental management and protect the environment.

EMS implementation and voluntarily proposing goals for continuous improvement will ensure the responsibility of the company for its operational activities related to the environment (Rondinelli and Vastag, 2000). Although the adoption of EMS is optional, it is an important strategic choice because it would reveal the organization's accountability to the stakeholders for adverse environmental impacts (King and Lenox, 2002), such as GHG emissions. Furthermore, studies have shown that GHG emissions diminish as the organizations implement EMS and ensure the adoption of appropriate environmental policies (Capece et al., 2017).

Furthermore, the RGHG through EMS implementation may enhance EP (Lash and Wellington, 2007). This could occur through increased sales to environmentally aware clients and cost reduction associated with improved productivity (Capece et al., 2017; Cucchiella et al., 2017). Understanding the importance of EMS can help RGHG (Rosa et al., 2015) and improve EP (Nawaz and Koç, 2018). A bivariate probit model for six indicators of environmental performance (natural resource use, solid waste generation, wastewater effluence, local and regional air pollution, global pollutants, and the aggregate index) shows that environmental performance has a positive and significant effect on both profitability and sales, indicating the potential for "win-wins" (Darnall et al., 2007). Thus, we have the following hypotheses:

H1a. EMS implementation is positively associated with RGHG.

H1b. EMS implementation is positively associated with EP.

2.2. The aspect of CSR

CSR and its implications have been discussed in the academic literature since the 1950s; CSR includes the economic, legal, ethical, and discretionary expectations of society regarding organizations (Carroll, 1979). From the organizations' perspective, CSR aims to meet the stakeholders' expectations through responsible and ethical corporate behavior (Whetten et al., 2002).

In practice, CSR is a set of environmental and social management strategies to accomplish organizational interests and simultaneously promote social benefits, meeting all legal requirements (Carroll, 1998) and sometimes even going much beyond what is legally required (Peloza, 2009). Therefore, CSR is a management process to identify and incorporate the stakeholders' environmental concerns into the company's management policies (Freeman, 1994). Its integration into the business strategy is essential (Sandoval, 2015) to reduce the environmental risks (Bauer and Hann, 2010) and simultaneously achieve the organization's social, economic, and environmental goals (Aguinis and Glavas, 2012). CSR accounts for the internal and external pressures from diverse stakeholders to incorporate environmental accountability into the organizations' corporate goals (Sandoval, 2015).

From the external perspective, the society's legal, ethical, and discretionary aspects relating to businesses (Carroll, 1979; Liu, 2018) and regulatory pressures (Zhu and Sarkis, 2007) must interact with one another (Liu, 2018) to obtain competitive advantage (Aguinis and Glavas, 2012), create corporate value with responsibility (Margolis and Walsh, 2003), and reduce GHG emissions (Liu, 2018). From the internal perspective, all aspects related to corporate motivations, regulations, and certifications can be viewed as a management opportunity or commitment to CSR in the pursuit of organizational efficiency (Aguinis and Glavas, 2012). Furthermore, the managers' individual awareness and involvement as well as the employees' awareness and engagement may be related to the resources or endeavors of the company contributing to environmental management (Aguinis and Glavas, 2012).

In this context, the top managers' engagement, adequate resources, efficient communication, and training are essential for the successful implementation of CSR (Benavides-Velasco et al., 2014). Therefore, CSR may become a management process contributing to EMS by identifying the stakeholders' interests in environmental management (Freeman, 1994). From the internal perspective, CSR may be seen as integrating environmental management and corporate responsibility through the managers' and employees' individual responsibilities and actions. Thus, CSR or the management's commitment simultaneously achieves the firm's economic, social, and environmental goals.

The managers' accountability to stakeholders focuses on important decisions with regard to corporate management and practical CSR implications (Stevens et al., 2005). Here, the term accountability refers to the managers' responsibility for the consequences of their actions and decisions, that is, taking responsibility for the impacts caused to society, the economy, and the environment and being answerable to all corporate governance bodies and other stakeholders for their failures and achievements (Warner and Verhallen, 2005).

Studies indicate that organizations are willing to implement environmental management systems that reduce the adverse environmental impacts and GHG emissions. This is because they realize that they may be held accountable to external agents formed by society if the consumers and regulators seek information on the application of resources made available (Braham et al., 2016). Schommer and Fischer (1999) showed that organizations with well-defined and clear policies on their environmental action tend to respond with higher accountability.

Another key aspect relates to the incentives paid to managers. Companies deciding to implement EMS have a competitive edge ensuring their supremacy in the market. These companies make an effort to implement EMS in order to enhance their corporate image and reputation, enter new markets, and thus improve their EP. Studies have shown that incentives provided to employees (e.g., profit sharing, better health insurance plans, education allowances, and leisure spaces) improve organizational efficiency (Peters and Mullen, 2009; Aguinis and Glavas, 2012).

Evidence also indicates that aspects related to the stakeholders' training contribute to economic and environmental performance, because the stakeholders' understanding and awareness of environmental management can make EMS implementation easier (Weaver et al., 1999; Stevens et al., 2005; Machete et al., 2016). According to Muller and Kolk (2010), training on the implementation of environmental policies and actions increases the likelihood of success and improves long-term performance. Pratt and Ashforth (2003) noted that training contributes to the awareness of one's socio-environmental responsibility, which is important to increase employee engagement. From the internal CSR perspective, the aspects related to managerial accountability and incentives as well as stakeholder and employee training impact the relationship between EMS and economic and environmental performance. Thus, we have the following research hypotheses:

H2a. The internal CSR pressures moderate the relationship between EMS and RGHG.

H2b. The internal CSR pressures moderate the relationship between EMS and EP.

Consequent to the climate policy discussions that have progressed since 2010, many countries have pledged to limit or reduce

their GHG emissions. However, such trajectories have important consequences and risks (Friedlingstein et al., 2014). Strategies such as developing low carbon cities have become essential because of the scarce investments in developing and applying new GHG emission reduction technologies. Thus, the enterprises that were forced to suspend production because their GHG emissions exceeded the stipulated standards could revive and generate more social and economic returns (Liu and Deng, 2011).

However, the economic impacts of climate change are already apparent; for example, heat waves are increasing the health costs and employee absenteeism, and reducing crop yields (Sterner, 2015). Climatic warming and its impacts on biophysical and human systems have been widely documented. The frequency and intensity of extreme weather events have also changed, but the observed increases in natural disaster losses are often viewed solely from the perspective of societal change, such as increased exposure and vulnerability. Moreover, economic losses have been little studied (Estrada et al., 2015).

The control of GHG emissions has been an international priority for decades. After more than two decades of negotiations, GHG emissions have been rapidly falling since 2000, despite the continued global economic growth. This trend is a welcome change from the historical coupling of CO2 emissions and economic growth, and must be strengthened through global policy efforts (Jackson et al., 2015). Many climate and emission milestones have been reached. However, we need to continue with this emission reduction scenario through both global policies and corporate effort. For this, companies have to focus on EMS implementation.

Studies have shown that one of the benefits of EMS implementation is RGHG emissions (Nawaz and Koç, 2018). As companies discuss, define, and implement EMS for RGHG emissions, the EP of these companies tends to improve (Yu and Lee, 2017); however, we need to consider environmental management as an organizational strategy (Nishitani et al., 2011). For example, by replacing lamps and equipment, using solar panels, selecting suppliers, and training employees, companies can reduce their energy consumption as well as their costs and GHG emissions. Thus, we derive the final hypothesis of this research, which addresses the RGHG emissions and improved performance. In addition, Zhao et al. (2017), who recently conducted a survey of Chinese companies, found that enterprises implementing the low-cost plan show superior EP as well as reduced carbon emissions.

H3. RGHG is positively associated with EP.

3. Methodology

3.1. Data collection

The primary data for this study were collected from a questionnaire survey conducted by the São Paulo Stock Exchange (BOVESPA), ISE – *Business Sustainability Index* - covering companies of different economic sectors and business sizes, with publicly available responses from 63 Brazilian companies listed on the stock exchange in 2016. Data characteristics such as minimum sample size, abnormal data, and measurement scale (i.e., the use of different scale types) are among the most noted reasons for applying Partial Least Squares-Structural Equation Modeling (PLS-SEM) (Henseler et al., 2009; Hair Jr. et al., 2016). The sampling of businesses included industrial goods (2), construction and transportation (12), cyclical consumption (3), non-cyclical consumption (3), financial and others (6), basic materials (4), information technology (2), telecommunications (2), and electricity (29).

The questionnaire survey by the São Paulo Stock Exchange compared the performance of companies listed in B3 under the corporate sustainability aspect, as shown in the appendix. Specifically, in this study, we examine the issues related to climate change based on nine objective questions related to EMS, CSR, and the results. From among these issues, we focus on the relationship between EMS and CSR.

The ISE is a tool used to compare the performance of companies listed in B3 under the corporate sustainability aspect based on economic efficiency, environmental balance, social justice, and corporate governance. It was created in 2005 to support investors in making socially responsible investment decisions and persuading companies to adopt best practices for corporate sustainability. To this end, companies that voluntarily participate in this portfolio have to respond to a questionnaire. The selection process was based on the answers provided by the companies. Developed by the FGVces team, this questionnaire evaluate various aspects of sustainability along the following seven dimensions: overall; product nature; corporate governance; economic, financial, environmental, and social; and climate change. Under this methodology, the same weight (100) is assigned to each of the seven questionnaire dimensions. Each dimension is subdivided into criteria based on the above subjects. The weights of these criteria are defined by the relevance of the subject in the current business management context and the demands of society. Management practices and performance are privileged subjects. In addition to the questionnaire answers, the selection process included an analysis of the documents presented by the companies to substantiate the information provided and for a final deliberation by the ISE Deliberative Council, CISE. The technical process was managed by Getulio Vargas Foundation (FGV), with the guarantee of KPMG.

The 2016 questionnaire was based on the changes proposed during the public consultations carried out from March to May that year, considering a total of 264 contributions from companies and other stakeholders. The consultation process was carried out by the Center for Sustainability Studies of the FGV, the technical partner of B3 at ISE. The results debated and approved by the ISE Deliberative Council in early June indicated certain important trends in the field of corporate sustainability (ISE, 2018).

3.2. Variable measurement

To examine how internal CSR pressures moderate the relationship between EMS and environmental and economic performance, we consider nine variables. As the independent variable, we use two variables to represent the EMS, one related to the mitigation of impacts, and the other related to the prediction of impacts. We use four dependent variables, two of which represent RGHG aspects, and two, EP. Finally, three moderating variables are used to measure the internal CSR pressures: accountability, incentives, and training. Table 1 shows the theoretical basis and the measurement of each variable.

3.3. Empirical model

To analyze the data, the PLS-SEM was used as an adequate technique in exploratory research. This can be used to test or expand theoretical propositions and is ideal for research using ordinal scales to measure the variables (Hair et al., 2016). In this study, we used CSR and EP to measure the level of Environmental Management Accounting - EMA, with ordinal scales ranging from 0 to 8, where “0” represented the worst level of response, indicating the absence of data or inferior performance, as shown in the appendix.

We quantified the proposed causal relationships using the PLS algorithm (the path coefficients and R2 for each dependent

Table 1
Variable measurement.

	Variable	Reference	Measurement
Environmental Management System	Mitigation and Prediction of impacts	ISE/BOVESPA Melnyk et al. (2002); Nishitani et al. (2011); Khalili and Duecker (2013); Nawaz and Koç (2018)	Which alternative best represents the company's performance the last year with respect to mitigation of its own emissions? Scale from 0 (no emissions) to 3 (accomplishes emissions mitigation and uses compensation measures). In the last three years, has the company made any progress in studying the vulnerability to climate changes and the potential impacts on business? Scale from 0 (no studies) to 4 (conducted studies in the last 3 years).
Internal Corporate Social Responsibility pressures	CSR-Accountability	ISE/BOVESPA Dhaliwal et al. (2011)	Please indicate which hierarchical levels are accountable for the management of risks and opportunities related to climate changes. Scale from 0 (no accountability) to 4 (all hierarchical levels are accountable for risks and opportunities).
	CSR-Incentives	ISE/BOVESPA Agan et al. (2016); Wang and Sarkis (2017)	Please indicate which hierarchical levels receive monetary incentives (variable remuneration, different salary increases, bonus, rewards) linked to performance goals in the management of GHG emissions. Scale from 0 (none) to 5 (all hierarchical levels are included in the incentives plan).
	CSR-Training	ISE/BOVESPA Agan et al. (2016)	Please indicate whether awareness-raising action or training of the internal public, including direct employees and outsourced workers and/or other public, have been promoted by the company. Scale from 0 (none) to 8 (promotes training to employees and other workers/stakeholders)
Environmental Performance	RGHG-Proof	ISE/BOVESPA Nishitani et al. (2011); Nawaz and Koç (2018); Yu and Lee (2017)	Does the company make an inventory of its reduction of GHG emissions? Scale from 0 (no inventory) to 6 (has inventory of direct and indirect emissions throughout the production process and value chain).
	RGHG-Goals	ISE/BOVESPA Nawaz and Koç (2018); Yu and Lee (2017)	Did the company attain the targets of absolute or relative reduction of GHG set the last year? Scale from 0 (no) to 2 (attained and/or exceeded)
Economic Performance	EP-ROA	Rosa et al. (2015); Wang et al. (2016); Fan et al. (2017); Yu and Lee (2017); Wang and Sarkis (2017) Xianbing and Anbumoz (2009); Wang et al. (2016) Fan et al. (2017)	Return on assets (ROA)
	EP-ROE		Return on equity (ROE)

construct), and conducted bootstrapping analysis considering 5000 samples to analyze the significance of the parameters. We used no sign changes or basic bootstrapping tests, as recommended by Hair Jr. et al. (2016)(see Fig. 1).

The present study assumes that EMS enables RGHG (H1a) emissions and improves EP (H1b). Thus, the relation is considered positive such that in H1a, the use of EMS is positively associated with RGHG emissions, and in H1b, the use of EMS is positively associated with EP.

The model assumes that the internal CSR pressures influence environmental and economic performance. Thus, the aspects related to the managers' responsibility and incentives and the stakeholders' and employees' training influence the relationship between EMS and environmental and economic performance. Thus, we have the following research hypotheses: H2a: The internal CSR pressures moderate the relationship between EMS and RGHG. H2b: The internal CSR pressures moderate the relationship between EMS and EP. The deployment of EMS is assumed to reduce GHG emissions, and this reduction improves EP. H3: The use of RGHG is positively associated with EP.

The factor loadings explain the correlations between the observed variables. An evaluation of the moderator variable's measurement model shows that the constructed measures are reliable and valid. All indicator loadings are greater than 0.65, as recommended by Hair et al. (2016). Table 1 shows how well each indicator is correlated with the construct it is connected to. The composite reliability (CR) values from the model exceeded the suggested-as-acceptable value of 0.7 (CR = 0.702). These results indicate that the measurement met the reliability criteria. Hair et al. (2016) suggested the mean extracted variance (AVE) as a measure of convergent validity. Table 2 shows that the AVEs ranged from 0.54 to 0.94, with 0.7 considered a very good value and greater than 0.5 considered acceptable, suggesting satisfactory convergent validity (Hair et al., 2016). These results support the model's discriminant validity.

To assess the overall performance of the model, we use the global criterion standardized root mean square residual (SRMR). The SRMR is defined as the root mean square discrepancy between the observed correlations and the model-implied correlations. The result shows an SRMR value of 0.11, indicating good model fit. Initial simulation results suggest that the SRMR is capable of identifying a range of model misspecifications (Henseler et al., 2014; Hair Jr. et al., 2016).

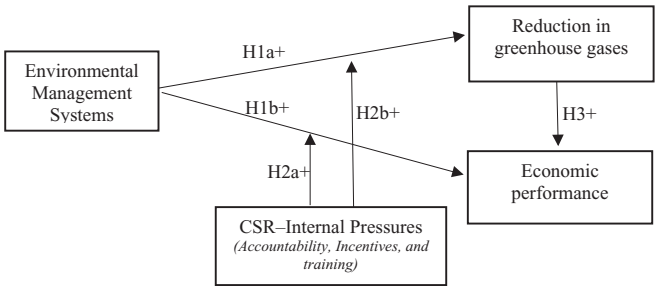

Fig. 1. Empirical model of the relationship between the internal CSR factors of an EMS, and RGHG emissions and EP.

4. Results and discussion

The results indicate a positive relationship between EMS, and RGG emissions ($p > 0.001$) and EP ($p > 0.10$). The relationship between EMS and RGHG is moderated by the internal CSR pressures significance level of 0.023 ($p > 0.05$). The relationship between EMS and EP is moderated at the significance level of 0.004 ($p > 0.01$); see Fig. 2.

Fig. 2 shows the research model and the relation between EMS and RGHG on the one hand and EP on the other, which moderate the CSR variables. The model did not present a positive relationship between RGHG and EP ($p = 0.758$).

Companies need to seek ways to reduce their risk exposure by

Table 2
Reliability of the measurement model.

Variables	Factor Loadings	Composite Reliability	Average Variance Extracted (AVE)
CSR-Accountability	0.810	0.864	0.680
CSR-Incentives	0.871		
CSR-Training	0.791		
EMS-Short term	0.746	0.702	0.541
EMS-Long term	0.725		
EP-ROA	0.968	0.970	0.942
EP-ROE	0.974		
RGHG-Proof	0.922	0.772	0.636
RGHG-Goals	0.649		

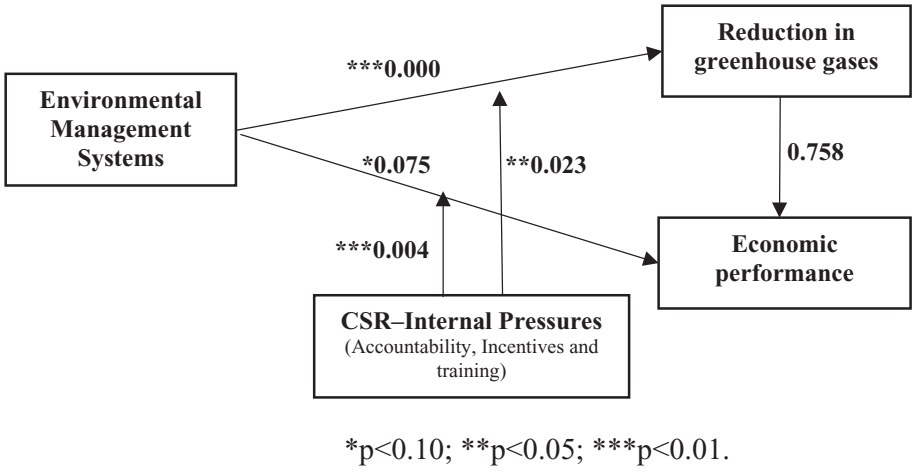

Fig. 2. Results of the PLS research model.

acting proactively and improving their relationship with the environment (Phan and Baird, 2015). This study verified whether EMS and RGHG emissions are positively associated. The findings confirm Hypothesis H1a and agree with in the observations of other studies such as King and Lenox (2002), Darnall et al. (2007), and Capece et al. (2017) that GHG emissions have reduced with EMS implementation, and thus allow environmental policy implementation.

Since companies are urged to reduce their risk exposure, they must act proactively and improve their relationship with the environment (Phan and Baird, 2015). This study also verified whether EMS and RGHG emissions are positively associated. Our findings support Hypothesis H1a, and agree with the observations of other studies such as King and Lenox (2002), Darnall et al. (2007), and Capece et al. (2017) that GHG emissions diminish with EMS implementation, and thus enable environmental policy implementation.

The voluntary adoption of EMS may be an important strategy for organizations in their relationship with stakeholders since it indicates the company's concerns about the environmental impacts of its activities. In this regard, some studies report better EP with EMS implementation (Bansal and Bogner, 2002; Lash and Wellington, 2007) due to the cost reductions associated with higher productivity (Agan et al., 2016). This study also supports Hypothesis H1b, which verified whether EMS is positively associated with improved EP of the company ($p > 0.10$), corroborating the findings of Nishitani et al. (2011), Nishitani and Kokubu (2012), and Capece et al. (2017), who found that companies with well-defined environmental policies and a structured EMS show better EP.

CSR considers the stakeholders' interest to incorporate environmental issues in company management (Freeman, 1994). To minimize environmental hazards (Bauer and Hann, 2010; Braham et al., 2016), business strategies need to be integrated (Sandoval, 2015) for better economic, social, and environmental performance (Aguinis and Glavas, 2012). Accordingly, this study also examined the relationship between EMS and RGHG, which is moderated by the internal CSR pressures (accountability, incentives, and training). We can expect the CSR aspects (accountability, incentives, and training) to positively change the relationship between EMS and RGHG (H2a). The results confirm this expectation based on the positive association between the variables. These findings are supported by Warner and Verhallen (2005) and Stevens et al. (2005), who showed that EMS has a positive influence on RGHG emissions based on the CSR attributes of accountability (Braham et al., 2016), incentives (Peters and Mullen, 2009), and training (Machete et al., 2016).

We also found that the internal CSR pressures (accountability, incentives, and training) positively change the relationship between EMS and EP (H2b). Our findings support this hypothesis and agree with previous studies on the topic, where the CSR internal pressure aspects, that is, accountability (Warner and Verhallen, 2005), incentives (Aguinis and Glavas, 2012), and training (Muller and Kolk, 2010), have a positive influence on the relationship between EMS and EP.

Finally, a positive and significant association was expected, but Hypothesis H3 is not supported since there was no positive and significant relationship between RGHG emissions and EP ($p = 0.758$). These results are contrary to the findings of Peters and Mullen (2009), Wang et al. (2016), and Fan et al. (2017). The possible explanations include the financial crisis, where economic recovery is prioritized to the detriment of environmental issues, or the fact that RGHG emissions was not considered strategic to the organization, as reported by Nishitani et al. (2011).

5. Conclusions

This study explored the influence of the internal CSR pressures on the relationship between EMS and performance (RGHG emissions and EP). To do so, we used primary data from a questionnaire survey conducted by the São Paulo Stock Exchange (BOVESPA), covering companies of different economic sectors and business size, with publicly available responses from 63 Brazilian companies listed on the stock exchange in 2016. For data analysis, we used PLS-SEM.

We verified that EMS interacts with social responsibility and encourages managers to internalize issues related to the environment in order to improve the company's environmental performance in RGHG emissions and EP. The results indicate RGHG emissions through EMS implementation and appropriate environmental policies, and the positive association of EMS with higher EP of the company. We also found that the CSR internal pressures (accountability, incentives, and training) positively changed the relationship between EMS, RGHG emissions, and the organization's EP.

This paper contributes to the environmental management literature as follows. First, we examined the use of EMS to mitigate and prevent the environmental impacts of GHG emissions. Second, we analyzed the complementary effect of EMS on EP. Third, we simultaneously examined the effect of the internal aspects (accountability, incentives, and training) of CSR on the relationship between EMS and EP, and on the relationship between EMS and RGHG emissions, probably for the first time in the literature, although considerable attention has been paid to the relationship between EMS and performance. The authorities responsible for the appointment of managers should pay more attention to the responsibilities of decision makers, the incentives/rewards provided to managers and employees, and the stakeholders' training under the assumption that the aspects related to individuals can improve the relationship between the management system and performance.

For future research, we suggest broader studies on the managers' individual awareness, focusing on identifying the managerial characteristics and other motivations affecting the decisions on EMS implementation for RGHG emissions and other environmental impacts. In addition, studies investigating the determinants of RGHG emissions are vitally important. Additionally, since there is no consensus in the literature on the relationship between RGHG emissions and EP, studies need to examine the factors such as strategy, internal controls, and organizational resources that could influence this relationship.

6. Political implications

The present study considered the companies participating in socially responsible investments, ISE/BOVESPA – Corporate Sustainability Index of the São Paulo Stock Exchange/Brazil. In addition, we showed how CSR improves the environment and EP of these companies. Such studies may have political implications because they analyze companies voluntarily participating in socially responsible investment portfolios such as ISE. The ISE aims to induce good practices in the Brazilian business environment and be a reference for investments oriented toward sustainable development.

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Appendix

Measuring variables: EMS

FIRST QUESTION

CLI-10. Which alternative best represents the company's performance the last year in relation to the mitigation of its own emissions?

POSSIBLE ANSWER AND MEASUREMENT

3 POINTS. ANSWER: The company used emission compensation as the primary means to achieve its GHG emissions targets.

2 POINTS. ANSWER: The reduction of its own emissions was the main strategy of the company to achieve its goals related to GHG emissions, and the company did not use emission compensation as a complementary instrument.

1 POINT. ANSWER: The reduction of its own emissions was the main strategy of the company to achieve its goals related to GHG emissions, and the company used emission compensation as a complementary instrument.

0 POINT. ANSWER: None of the above.

SECOND QUESTION

CLI-14. Has the company made any progress in the past three years and/or is it developing studies regarding its vulnerabilities in the face of climate change and its potential impacts on business?

POSSIBLE ANSWER AND MEASUREMENT

4 POINTS. ANSWER: Yes, it is mobilizing internal and external actors to map vulnerabilities.

3 POINTS. ANSWER: Yes, it is mobilizing only external actors.

2 POINTS. ANSWER: Yes, it is mobilizing only internal actors.

1 POINT. ANSWER: No, but there is a study under preparation to consider at least the definition phase of the scope; a responsible and involved team has been made, and a risk diagnosis and identification of potential impacts has been developed.

THE POINT. ANSWER: No.

Measuring variables: Internal pressures of CSR.

THIRD QUESTION

CLI-5. Indicate to which hierarchical levels responsibilities are assigned for the management of risks and opportunities related to climate change.

POSSIBLE ANSWER

a) Second level;
b) First level;
c) Chief Executive Officer;
d) Other employees;
e) None of the above

MEASUREMENT

For this question, the answer of "D" is assigned 0 points. For other issues, each item is worth 1 point, and you can choose more than one item. Thus, each indicated item adds 1 point.

FOURTH QUESTION

CLI-6. Indicate to which hierarchical levels an economic incentive is established (variable remuneration, differentiated salary adjustments, bonuses, premiums) linked to performance targets in GHG emissions management.

POSSIBLE ANSWER AND MEASUREMENT

a) Second level;
b) First level;
c) Chief Executive Officer;

d) Other employees;
e) None of the above

MEASUREMENT

For this question, the answer of "D" is assigned 0 points. For other issues, each item is worth 1 point, and you can choose more than item. Thus, each indicated item adds 1 point.

Measuring variables: Environmental Performance.

FIFTH QUESTION

CLI-7. Indicate that awareness-raising or training of the company promotes what is aimed for its internal public, including direct employees and outsourced workers, and/or other public: Internal public; Other audiences; NDA.

POSSIBLE ANSWER

a) Dissemination of information related to the issue of climate change;
b) Measurement and reporting of GHG emissions;
c) Opportunities to reduce GHG emissions;
d) Analysis of risks and vulnerabilities to the impacts of climate change (D); record of the trainings carried out, such as attendance list of the participants and dissemination material on the training offered; documents proving the accomplishment of internal campaign or other activities of sensitization that indicate the content the target public.

MEASUREMENT

Scale from 0 (none) to 8 (promotes training for internal public and other stakeholders).

QUESTION 6

CLI-17 and CLI-17.1 Does the company incorporate GHG emissions into the process of systematically evaluating the environmental aspects and impacts of its activities? If YES, are there specific processes and procedures for the management of GHG emissions?

POSSIBLE ANSWER AND MEASUREMENT

Scale from 0 (insufficient) to 6 (perform inventory for direct and indirect emissions throughout the production process and its value chain).

QUESTION 7

CLI-19. Have previously established GHG reduction targets, whether absolute and/or relative, been met by the company the last year?

POSSIBLE ANSWER AND MEASUREMENT

2 POINTS. ANSWER: Yes, they were met and surpassed.

1 POINT. ANSWER: Yes, they were met.

0 POINT. ANSWER: Has no established GHG emission reduction targets (D), internal records, or vehicles where GHG emission targets and inventories and/or intensity indicator information are published.

Measuring variables: EP.

QUESTION 8

Return on Assets (ROA).

ROA = Net Income/Total Assets.

QUESTION 9.

Return on equity (ROE).

ROE = Net profit/Net worth.

References

Agan, Y., Kuzey, C., Acar, M.F., Açıkgoz, A., 2016. The relationships between corporate social responsibility, environmental supplier development, and firm performance. J. Clean. Prod. 112 (3), 1872–1881.

Aguinis, H., Glavas, A., 2012. What we know and don't know about corporate social responsibility a review and research agenda. J. Manag. 38 (4), 932–968.

Albelda-Perez, E., Correa-Ruiz, C., Carrasco-Fenech, F., 2007. Environmental management systems as an embedding mechanism: a research note. Account. Aud. Accoun. 20 (3), 403–422.

Bansal, P., Bogner, W.C., 2002. Deciding on ISO 14001: economics, institutions, and context. Long. Range Plan. 35 (3), 269–290.

Bauer, R., Hann, D., 2010. Corporate Environment Management and Risk. SSRN. Working Paper. Maastricht University.

Benavides-Velasco, C.A., Quintana-García, C., Marchante-Lara, M., 2014. Total quality management, corporate social responsibility and performance in the hotel industry. Int. J. Hospit. Manag. 41, 77–87.

Braham, W.W., Butcher, L., Kurtz, J.S., Roudsari, M.S., Vyas, J., 2016. The new chautauqua game: designing the renewable city and region using E[m]ergy accounting. J. Environ. Account. Manag. 4 (2), 209–221.

Capece, G., Di Pillo, F., Gastaldi, M., Levialdi, N., Miliacca, M., 2017. Examining the effect of managing GHG emissions on business performance. Bus. Strateg. Environ. 26, 1041–1060.

Carroll, A.B., 1979. A three-dimensional conceptual model of corporate social performance. Acad. Manag. Rev. 4, 497–505.

Carroll, A.B., 1998. Corporate Social Responsibility, vol. 38. Business & Society, pp. 268–295.

Chan, E.S.W., Wong, S.C.K., 2006. Motivations for ISO 14001 in the hotel industry. Tourism Manag. 27 (3), 481–492.

Chuang, L., Qianfei, L., 2013. The motivation analysis of enterprises voluntarily implementing environmental management system. In: 25th Chinese Control and Decision Conference. CCDC), pp. 4855–4858.

Cucchiella, F., Gastaldi, M., Miliacca, M., 2017. The management of greenhouse gas emissions and its effects on firm performance. J. Clean. Prod. 167, 1387–1400.

Darnall, Nicole, Jolley, G. Jason, Ytterhus, Bjarne, 2007. Understanding the relationship between a facility's environmental and financial performance. In: Johnstone, N. (Ed.), Environmental policy and corporate behaviour. Edward Elgar/OECD, pp. 213–259 (Chapter 6).

Dhaliwal, D., Li, O., Tsang, A., Yang, G., 2011. Voluntary nonfinancial disclosure and the cost of equity capital: the initiation of corporate social responsibility reporting. Account. Rev. 86 (1), 59–100.

Estrada, F., Botzen, W.J.W., Tol, R.S.J., 2015. Economic losses from US hurricanes consistent with an influence from climate change. Nat. Geosci. 8, 880–884.

Fan, L.W., Pan, S.J., Liu, G.Q., Zhou, P., 2017. Does energy efficiency affect financial performance? Evidence from Chinese energy-intensive firms. J. Clean. Prod. 151 (10), 53–59.

Fortuński, B., 2008. Does the environmental management standard ISO 14001 stimulate sustainable development? An example from the energy sector in Poland. Manag. Environ. Qual. Int. J. 19 (2), 204–212.

Freeman, R.E., 1994. The politics of stakeholder theory. Bus. Ethics Q. 4 (4), 409–421.

Friedlingstein, P., Andrew, R.M., Rogelj, J., Peters, G.P., Canadell, J.G., Knutti, R., et al., 2014. Persistent growth of CO2 emissions and implications for reaching climate targets. Nat. Geosci. 7, 709–715.

Fryxell, G.E., Szeto, A., 2002. The influence of motivations for seeking ISO 14001 certification: an empirical study of ISO 14001 certified facilities in Hong Kong. J. Environ. Manag. 65 (3), 223–238.

Guerrero-Baena, M.D., Gómez-Limón, J.A., Fruet, J.V., 2015. A multicriteria method for environmental management system selection: an intellectual capital approach. J. Clean. Prod. 105, 428–437.

Hair Jr., J.F., Hult, G.T.M., Ringle, C., Sarstedt, M., 2016. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications.

Henseler, J., Ringle, C.M., Sinkovics, R.R., 2009. The use of partial least squares path modeling in international marketing. Adv. Int. Market. 20, 277–319.

Henseler, J., Dijkstra, T.K., Sarstedt, M., Ringle, C.M., Diamantopoulos, A., Straub, D.W., Ketchen, D.J., Hair Jr., J.F., Hult, G.T.M., Calantone, R.J., 2014. Common beliefs and reality about PLS: comments on Rönkkö & Evermann (2013). Organ. Res. Methods 17 (2), 182–209.

Indice de Sustentabilidade Empresa – ISE, 2018. Bolsa de Valores de São Paulo. Disponível em. http://www.bmfbovespa.com.br/pt_br/produtos/indices/indices-de-sustentabilidade/indice-de-sustentabilidade-empresarial-ise.htm. Consultado em 12/01/2018.

Jackson, R.B., Canadell, J.G., Quéré, L.C., et al., 2015. Reaching peak emissions. Nat. Clim. Change 6, 7–10.

Khalili, N.R., Duecker, S., 2013. Application of multi-criteria decision analysis in design of sustainable environmental management system framework. J. Clean. Prod. 47, 188–198.

King, A., Lenox, M., 2002. Exploring the locus of profitable pollution reduction. Manag. Sci. 48 (2), 289–299.

Kuo, L., Yeh, C.C., Yu, H.C., 2012. Disclosure of corporate social responsibility and environmental management: evidence from China. Corp. Soc. Responsib. Environ. Manag. 19 (5), 273–287.

Lash, J., Wellington, F., 2007. Competitive advantage on a warming planet. Harv. Bus. Rev. 85 (3), 95–102.

Liu, Y., 2018. Exploring the relationship between external positive–negative pressures and the carbon management behaviour of industrial firms. Corp. Soc. Responsib. Environ. Manag. (in press).

Liu, X., Anbumozhi, V., 2009. Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. J. Clean.

Prod. 17, 593 e 600.
Liu, J., Deng, X., 2011. Impacts and mitigation of climate change on Chinese cities. Curr. Opin. Environ. Sustain. 3 (3), 188–192.
Machete, F., Hongoro, C., Nhamo, G., Mearns, K.F., 2016. The use of environmental accounting to determine energy saving in mpumalanga hotels, South Africa. J. Environ. Account. Manag. 4 (4), 413–422.
Margolis, J.D., Walsh, J.P., 2003. Misery loves companies: rethinking social initiatives by business. Adm. Sci. Q. 48, 268–305.
Melnyk, S.A., Sroufe, R.P., Calantone, R.L., Montabon, F.L., 2002. Assessing the effectiveness of US voluntary environmental programmes: an empirical study. Int. J. Prod. Res. 40 (8), 1853–1878.
Muller, A., Kolk, A., 2010. Extrinsic and intrinsic drivers of corporate social performance: evidence from foreign and domestic firms in Mexico. J. Manag. Stud. 47, 1–26.
Naranjo-Gil, D., 2016. The role of management control systems and top teams in implementing environmental sustainability policies. Sustainability 8, 359.
Nawaz, W., Koç, M., 2018. Development of a systematic framework for sustainability management of organizations. J. Clean. Prod. 171 (10), 1255–1274.
Nishitani, K., Kokubu, K., 2012. Why does the reduction of greenhouse gas emissions enhance firm value? The case of Japanese manufacturing firms. Bus. Strateg. Environ. 21 (8), 517–529.
Nishitani, K., Kaneko, S., Fujii, H., Komatsu, S., 2011. Effects of the reduction of pollution emissions on the economic performance of firms: an empirical analysis focusing on demand and productivity. J. Clean. Prod. 19 (17–18), 1956–1964.
Peloza, J., 2009. The challenge of measuring financial impacts from investments in corporate social performance. J. Manag. 35, 1518–1541.
Peters, R., Mullen, M.R., 2009. Some evidence of the cumulative effects of corporate social responsibility on financial performance. J. Global Bus. Issues 3 (1), 1.
Phan, T.N., Baird, K., 2015. The comprehensiveness of environmental management systems: the influence of institutional pressures and the impact on environmental performance. J. Environ. Manag. 160 (1), 45–56.
Porter, M.E., Van der Linde, C., 1995. Green and competitive: ending the stalemate. Harv. Bus. Rev. 120–134. September-October.
Pratt, M.G., Ashforth, B.E., 2003. Fostering meaningfulness in working and meaningfulness at work: an identity perspective. In: Cameron, K., Dutton, J.E., Quinn, R.E. (Eds.), Positive Organizational Scholarship, pp. 309–327.
Rondinelli, D., Vastag, G., 2000. Panacea, common sense, or just a label?: the value of ISO 14001 environmental management systems. Eur. Manag. J. 18 (5), 499–510.
Rosa, F.S., Ensslin, S.R., Ensslin, L., Lunkes, R.J., 2012. Environmental disclosure management: a constructivist case. Manag. Decis. 50 (6), 1117–1136.
Rosa, F.S., Guesser, T., Hein, N., Pfitscher, E.D., Lunkes, R.J., 2015. Environmental impact management of Brazilian companies: analyzing factors that influence disclosure of waste, emissions, effluents, and other impacts. J. Clean. Prod. 96, 148–160.
Rowland-Jones, R., Pryde, M., Cresser, M., 2005. An evaluation of current environmental management systems as indicators of environmental performance. Manag. Environ. Qual. Int. J. 16 (3), 211–219.
Sandoval, M., 2015. From CSR to RSC: a contribution to the critique of the political economy of corporate social responsibility. Rev. Radic. Polit. Econ. 47 (4), 608–624.
Schommer, P.C., Fischer, T., 1999. Cidadania empresarial no Brasil: os dilemas conceituais e a ação de três organizações baianas. Organizações & Sociedade 6 (15), 99–118.
Sterner, T., 2015. Economics: higher costs of climate change. Nature 527 (7577), 177–178.
Stevens, J.M., Steensma, H.K., Harrison, D.A., Cochran, P.L., 2005. Symbolic or substantive document? The influence of ethics codes on financial executives' decisions. Strat. Manag. J. 26, 181–195.
Swart, R.J., Raskin, P., Robinson, J., 2004. The problem of the future: sustainability science and scenario analysis. Global Environ. Change 14 (2), 137–146.
Wang, Z., Sarkis, J., 2017. Corporate social responsibility governance, outcomes, and financial performance. J. Clean. Prod. 162 (20), 1607–1616.
Wang, H., Lu, W., Ye, M., Chau, K.W., Zhang, X., 2016. The curvilinear relationship between corporate social performance and corporate financial performance: evidence from the international construction industry. J. Clean. Prod. 137 (20), 1313–1322.
Warner, J., Verhallen, A., 2005. Multi-stakeholder platforms for integrated catchment management. In: Towards a Comparative Typology. 11th MOPAN Conference 2004. Wolf Publishers, Nijmegen, pp. 213–226.
Weaver, G.R., Trevino, L.K., Cochran, P.L., 1999. Integrated and decoupled corporate social performance: management commitments, external pressures and corporate ethics practices. Acad. Manag. J. 42 (5), 539–552.
Whetten, D.A., Rands, G., Godfrey, P., 2002. What are the responsibilities of business to society? In: Pettigrew, A., Thomas, H., Whittington, R. (Eds.), Handbook of Strategy and Management. Sage, London, pp. 373–408.
Xianbing, L., Anbumoz, V., 2009. Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. J. Clean. Prod. 17 (6), 593–600.
Yu, J., Lee, S., 2017. The impact of greenhouse gas emissions on corporate social responsibility in korea. Sustainability 9 (7), 1135.
Zhao, R., Zhou, X., Jin, Q., Wang, Y., Liu, C., 2017. Enterprises' compliance with government carbon reduction labelling policy using a system dynamics approach. J. Clean. Prod. 63, 303–319.
Zhu, Q., Sarkis, J., 2007. The moderating effects of institutional pressures on emergent green supply chain practices and performance. Int. J. Prod. Res. 45 (18–19), 4333–4355.
Zutshi, A., Sohal, A., 2004. Environmental management system adoption by Australasian organisations part 1: reasons, benefits and impediments. Technovation 24 (4), 335–357.